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3 mm. in diameter and there is little difference in size between the small intestine and the rectum. The intestinal loops are naturally few and simply arranged as in many Passerine birds; there is nothing distinctive in their arrangement.

Examination of the sternum revealed the interesting fact that it is like that of any finch, the only peculiarity being in the manubrium which is very large with the two arms or divisions long and widely spreading. There is no trace of an "osseous bridge" from the anterior margin of the sternum to the manubrium such as occurs in *Piranga*, nor is there any bony roof, either with or without foramina, covering a space back of the anterior margin, such as occurs in *Saltator*, *Pipilo* et al. There are no differences to be seen between the sternum of the male in *Spindalis* and that of the female. The absence of the "osseous bridge" in this genus indicates either that its presence is not characteristic of all tanagers or else that *Spindalis* is not a tanager.

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## THE NEST LIFE OF THE SPARROW HAWK.

BY ALTHEA R. SHERMAN.

THE nesting of a species new to our place always is an event of great interest, and doubly so when the birds are of the hole-nesting sort, whose home life at very close range has never been exhibited (so far as is known) to mortal eye; but when the species is one of the *Raptores* interest heightens and feelings become indescribably mixed; there is the anxiety to watch the nest life mingled with fear for our harmless, little feathered friends, that trustingly have returned to their summer home; hence on April 4, 1912, it was with a perturbed mind that a pair of Sparrow Hawks (*Falco sparverius sparverius*) that had arrived the day before, were watched while they inspected the nest box occupied by Screech Owls two years previously.

Never before in our immediate neighborhood—National, Iowa—

had Sparrow Hawks nested, yet for years man and nature had been at work preparing the way for them. Four years prior to this lightning had smitten the tallest and fairest willow of a group of these trees, and its dead branches invited the Hawks to rest; there the home-seeking pair found facing them, eighty feet away, a hole in my bird blind that gave entrance to a nesting box whose bottom surface, eight by twelve inches in dimensions, was deeply covered with sawdust and excelsior. This place seemed to satisfy them for several days until they ventured to the barn, where they found eight other boxes similarly furnished for nesting and roosting places for Flickers. During the next two weeks they visited the various boxes and scratched in the excelsior, their choice of a nesting place seemingly pointing toward the barn, but in this they were not encouraged. Toward the end of April they again frequented the dead willow and the box in the blind became their final choice.

There the first egg was deposited on April 28 before eleven o'clock in the morning, and an egg was laid on each alternate day until the sixth, and last, on May 8. That the hour for laying was later than that of many common species appears from the fact that on April 30 the second egg had not been laid at half past nine in the morning, but was in the nest by four o'clock in the afternoon, when the nest was again visited and the female found at home. Each egg was weighed upon the day it was laid, and their weights in the order of laying were 212, 227, 220, 225, 228 and 204 grains respectively. Four of these salmon-colored eggs were very similar in appearance, bearing large blotches of a chocolate brown, the sixth egg was finely speckled instead of blotched, while the fifth was strikingly different from the others having large unmarked spaces of the ground color through the center, and some blotches on the ends. The bird that came from it was as marked in its disposition as the egg-shell was in its coloring.

Incubation was performed mainly by the female, only once was the male found in the nest, which he did not leave until the blind had been noisily entered, since by the female sitting on her favorite perch we had been led to think that the nest was unoccupied. On the other hand the female was accustomed to fly from the nest the instant the key touched the lock of the door, if she had not already flown upon hearing human footsteps or voices. Sometimes it was

noted that the eggs were left uncovered nearly or quite an hour, while both birds sat in their tree preening themselves, an exercise in which they spent a vast amount of time.

The first egg proved infertile, the third one, taken to reduce the number of hawks, also as a souvenir, contained a living embryo. Of the remaining eggs the second and fourth hatched on June 4, the bird from the former egg was still wet at 7.45 o'clock in the morning, and weighed 154 grains. The following morning at a quarter of eleven o'clock the hawklet from the fifth egg was found not thoroughly dry, weighing 166 grains, and showing that it had been fed. The bird from the sixth egg still wet, and weighing 139 grains, was found at half past eight o'clock on the morning of June 6. These data plainly show that the period of incubation must have been thirty days for the fifth egg, and twenty-nine days for the sixth egg.

Very soon after hatching the young would bite vigorously at a finger that touched their bills, opening their eyes for an instant as they did so, but not until they were two or three days old did they keep their eyes open longer than a few seconds at a time. From their first day they uttered a faint cry, when expecting food, that suggested the scream of the mature Sparrow Hawk, also peeps similar to a chicken but more mournful. This peeping was continuous while they were out of the nest. There was a third cry, difficult to describe, which they uttered when fed.

On June 13 the first manifestations of fear were detected, when the hawklets flattened themselves on the bottom of the nest, but such signs were rare for a few days thereafter. It was on the following day that for the first time they were seen ranged against the sides of the nest their backs to the wall; this arrangement appeared to be the normal one, thus the center of the nest was given to the one that was eating, or to the mother, when she came to feed them. When two weeks old they could run quite well; when placed on the floor of the blind they ran to the inner angles formed by the studdings and the walls, where with backs well braced they faced the foe, and a few days later met with savage claws an approaching hand.

At a very early age their alert bearing together with their bright eyes and snow-white plumage made a picture long to be remembered.

By June 10, the down, or more correctly the neossoptiles, began to look dirty and the next day pinfeathers showed in this covering. By the 13th, the pinfeathers had pushed these neossoptiles away from the body to such an extent that the nestling looked half clothed. At sixteen days of age the barbs of their remiges showed sufficiently for one to be positive concerning the sex of the hawklets, and it was learned that eggs Nos. 2 and 6 had contained males, and Nos. 4 and 5 females. It was the shell of the fifth egg that bore unusual markings. Could oologists (or the clutchers of eggs) have studied the life of the bird that came from this egg, it is believed that all would have been convinced that "what is in the egg" is of greater importance than the lifeless shell. Numerous visitors came to see the young Sparrow Hawks and a nestful of Flickers that were being reared in the barn. Two of these friends from a distance named the young hawks, bestowing on the older male the name of Jeremiah, and his younger brother, because of his extreme meekness, was called Moses; the females were named Ruth and Jezebel. The last mentioned was an extremely wicked little wretch. When but sixteen days old she began to fight. Upon the opening of the nest door that day the rest of the brood stood back against the side of the nest and opened their mouths, a feeding response probably, but with a threatening mien Jezebel stretched herself to her utmost height, some seven or eight inches, then struck at my hand repeatedly with her claws. From that day onward a marked difference was observed in behavior of the males and of the females. When a finger or a stick was pointed into the nest all opened their mouths; the males did little more than this as they hugged the farthest side of the nest, but the females, springing to the center of the nest, every feather on their heads standing out seemingly at right angles, wings spread, mouths open and squawking, were ready to claw and bite, Jezebel being the fiercer of the pair. When taken from the nest the rapidity with which she would whirl round, when a finger was circled above her, was remarkable especially at the early age of eighteen days. Sometimes clawing was done by Jerry, but Moses usually was as gentle as a dove. The record of their daily weights shows, that after the mother ceased to feed them, the females appropriated more than their share of food, in fact on June 22 it was noted that Moses,

one day younger than Jezebel, was five days behind her in weight, and three days in development of plumage. No strife over their food was ever witnessed. This yielding of their lawful share of food by the males may have had its origin in their disposition in mature life to give the food they bring to their mates. Ruth was found eating more frequently than the others.

Viewing of the nest when the mother bird was at home was eagerly sought. The blind in which the nest was located is a rude structure, forty-five inches square, built for shelter while watching Rails and migrating birds. In preparation for observing the nest while Mother Sparrow Hawk was at home the windows were completely darkened. Some cracks in the walls let in a little light, also a little fresh air, which in the latter days of the nest proved an appreciated blessing. Protection from the faint rays of light that penetrated through the cracks was afforded by the depths of a sun-bonnet. The keenness of vision of a hawk is proverbial, that these precautions were sufficient was proved when for a half hour undetected, I, sixteen inches away, looked through a peep-hole into the mother hawk's eye, and watched her as she brooded. This was not achieved upon the first attempt, when two hours were spent in fruitless waiting for her coming. After that, except near the close of the nest period when both parents were absent hunting, all attempts to watch the nest during the mother's visits were made after visitors to the blind had left me there alone. At first standing noiselessly upon a box with head scraping the roof of the blind for one hour, or for two hours, was not an easy task, later it became almost insupportable with the heat of an afternoon sun beating upon the blind, and with the stench from a nest, whose walls were thickly incrustated with excrements. But consummation was near at hand when hawk screams were heard from without, that called forth anticipatory peeps from the young after they were old enough to note the screams. When the mother came in there was little clamor and no struggling for food on the part of the nestlings. In their earlier days they merely braced themselves in the circle where they lay, later they stood in an orderly row against the side of the nest. With great rapidity the mother tore the flesh and bending her head almost at right angle with the bill of the young one she gave it the morsel. Her motions in this act were

very dainty and graceful; this bending of her head was apparently necessitated by the hooked beaks of both. Sometimes the pieces served were so large that they were swallowed with difficulty. No more than five minutes were occupied in these feedings. At first the food served was "dressed meat," and the remainders of the feast were carried out by the mother, and eaten by her in the dead willow. On June 17, she brought in the body of a half-grown ground squirrel with the skin still on, probably I frightened her out prematurely, since she left the remnant of the squirrel. It was not until a week later that she began regularly to leave the quarry for the hawklets to feed themselves. Thereafter she entered the nest with the food, but remained inside less than a minute, sometimes no more than twenty seconds.

Experiments were made with the nestlings to see if they would eat living animals. When quite young a blow-fly was given, and some days later newly hatched English Sparrows were put into their mouths, but all were rejected. On June 30, thirty-three English Sparrow nestlings and eggs were given them, among them were two live fledglings nearly ready to leave the nest. The eggs and the dead Sparrows were eaten, but the live Sparrows remained all day in the hawk nest uninjured. It appeared to be a case not of the "lion and the lamb" but of the Sparrow and the Sparrow Hawk lying down together. This escape from the eye of the mother bird must have been due to her very brief visits.

In the spring while the question: 'Shall or shall not the Sparrow Hawks be allowed to remain and increase their kind?' was pending, all available ornithological literature was searched to learn if possible the degree of danger from these Falcons, that was threatening our birds. Besides one writer's statement that to a family of Sparrow Hawks twelve small birds were brought in one day, there was the reliable data furnished by the examination of stomachs of this species. The figures given by Dr. Fisher show that eighteen per cent of the stomachs contained the remains of birds. This is the same percentage that was found for Screech Owls. In previous years we had harbored these predaceous little villains, and some small birds had survived, therefore it was decided to give the Sparrow Hawks a trial at the same time to watch closely their relations with other birds. The first birds disturbed by them

were the Phœbes; when the Hawks frequented the barn the Phœbes disappeared, but when the Hawks were frightened away Phœbe resumed her task of refitting the very old nest that had cradled so many generations of her species; and later two broods were raised there in safety. The Flickers were driven away from the barn, but returned there to nest after the Sparrow Hawks chose the blind for their nest site. The Flickers more expeditious than the Hawks in incubation hatched out their brood on June 6 — the first egg having been laid on May 21 —, this hatching chanced to be on the birthday of Moses, and a comparison of development of Flickers and Sparrow Hawks made an interesting study. The Flickers gained in weight a trifle faster, but were homely, whining, helpless little creatures after the Hawks were well feathered and active. Both species left their nest on the same dates.

After the female Hawk began incubation English Sparrows built a nest in another box in the blind not four feet distant, and there raised their brood. Next to these the species that nested nearest was the Red-headed Woodpecker. A pair of these birds began their nest on May 29, in the dead willow about half way to the top. They brought out but one offspring. It is impossible to say that any of their young were taken by the Hawks. The only time a disturbance was witnessed was on June 28, directly after the Red-heads had changed places in the nest. The female Sparrow Hawk left her perch a few feet away, went to the Red-head's hole and looked in; the departing Redhead returned and drove her away. Exactly forty-six feet from the trunk of the dead willow, and fifty feet or thereabout from a favorite perch of the female Hawk a pair of Mourning Doves raised a brood. Their young were flying about in the willows on June 20. Probably it was this pair that built its second nest in a cedar tree a few rods distant, and its third nest on the site of the second, where a Dove was sitting until September 8, after which she deserted her eggs, containing well developed embryos. This is considered worthy of mention because all the other Mourning Doves of the neighborhood had left before that date. Another pair of Mourning Doves raised two broods in the house yard. From a plum tree nest conspicuously in sight of the Sparrow Hawks a pair of Brown Thrashers brought out four young, which fully grown were following their parents, and begging



for food when the latter were building their second nest. Another pair of Brown Thrashers built their nests in gooseberry bushes, their first nest being 105 feet from the hawk tree, the second 200 feet from it. In both cases the young left their nest, but it is impossible to say that all escaped afterward.

Enough cases have been cited to show that these Sparrow Hawks were not nest robbers like the Blue Jays, neither did they take any of the chickens, numbering fully one hundred and fifty, that were brought out in a yard twenty rods from their tree. As far as my observations extended their avian victims were fledglings not long out of the nest; also that the Hawks were crafty enough not to prey to any great extent upon the birds in the immediate vicinity of their nest among which they were in bad repute. They were frequently mobbed by Bronzed Grackles, that made vicious passes at them, especially if one were eating, whereupon it raised its wings and screamed, perhaps screamed for mercy. A dash of the Kingbirds sent the Hawks squawking from their tree. Once a pair of Baltimore Orioles followed one of them to the tree and for some time acted as if they had a score to settle. At another time Meadowlarks raised a tumult and followed the Hawks. It was feared that the victim that time was the little Meadowlark, that with a Cowbird nest-mate had been watched and weighed from the day of their hatching, and had but recently left the nest. The Cowbird, seen at intervals later, was known to have escaped.

When the hawklets required the largest supply of food the greater part of four days, beginning June 26, was given to uninterrupted study of the home life of the Hawks. Various places were chosen from which to watch, until an upper window in the house was found the best. It was three hundred feet from the nest, but nearly twice that distance was traveled to reach the blind every time food was delivered in the nest. These trips were for verifying the identifications of the quarry, and in case it was a bird to secure its tarsi. The top of the willow was about level with my window from which with the aid of 8-power binoculars the behavior of the Hawks was easily seen. The male did the greater part of the hunting, but there were a few times when the female brought food of her own catching. The average length of the intervals between the bringing of the quarry was two hours and twenty-five minutes, the

longest interval being three hours and forty-three minutes, and the shortest twenty-three minutes. This refers to food that was brought into the tree, not to the nest, for the female frequently ate the game brought in. For example on June 28, she ate three birds, and was absent five times, which altogether amounted in duration to two hours and twenty minutes, when she may have eaten several other birds. The notes for that day show that the prey was: in the forenoon at 8.15 o'clock, a bird, which was eaten by the mother Hawk, as likewise was the bird brought at 10.07; at 11.30, a bird, taken to the nest, and in the afternoon at 3.01 o'clock, a meadow mouse, taken to the nest; at 4.00, a bird, eaten by the mother; at 6.55, a meadow mouse, which was taken to the nest as was the sparrow brought in at 7.17 o'clock. It is most likely that the father Hawk brought a piece of game early in the morning, and another piece about one o'clock in the afternoon, when for an hour observations were suspended. At noon that day the aggregate weight of the four hawklets was 7648 grains, and it was 8166 grains at half past seven in the evening, a difference of 518 grains, the known supply of food having been two meadow mice and one small sparrow. In the forenoon of June 25 there was brought to the young three half-grown ground squirrels and a bird.

At different times the character of the game varied; for a time nothing but ground squirrels was seen, followed by two days and a half when, excepting one squirrel, birds only were brought in, and this was succeeded by a similar period when only meadow mice were seen. It would appear from this that the male Hawk found a brood of young birds or mammals and hunted in their neighborhood until he had exterminated the whole brood. Confirmatory of this was a succession of four birds about equal in size, whose bodies resembled in shape those of young Brown Thrashers or Robins just out of the nest. After June 14 the identified quarry consisted of seventeen birds and nineteen mammals; of the latter eight were meadow mice and the rest ground squirrels. Besides these there were nine unidentified pieces, several of them apparently insects, that were fed the young after they left the nest. The tarsi of the eight bird victims found in the nest were sent to Washington, D. C., where Mr. E. R. Kalmbach and Mr. H. C. Oberholser very kindly identified them for me. Six of the eight were pronounced to belong to sparrows.

According to the economy of these Hawks incubation, the brooding and the feeding of the young, and the guarding of the nest was the part of the female, while the male hunted for the family; only once was he seen in or near the nest. A few times he circled overhead and joined in the screaming, when I was near the nest, his notes sounding thinner and in a higher key than those of his mate. At such times the female made a great commotion with her screaming and flying at me, notwithstanding all her noise and bluster she was an arrant coward, never coming nearer than four or five feet of my head. With a hundredth part of the provocation a Red-winged Blackbird or a Brown Thrasher would have hit, perhaps hurt a trespasser on its domain. After a time the female recognized me and began to scream, while I was still distant and nearly hidden by trees. The neighbors said that they knew when I appeared out of doors from the screaming of the Hawk. Other people, men, women, and children daily frequented the enclosure in which stands the bird blind, but her screams were reserved for me alone. To guard the nest she sat in the dead willow. In April both of the pair sat in the top of the tree, during incubation and the earlier days of the young the branches extending from the middle of the tree were used, and during the last ten days of the nest the top branches were again occupied.

Hunting was done for the most part to the southwest, the land there being devoted to farming, while the buildings of our decadent hamlet are situated in the other directions. Immediately to the southwest of the hawk tree lay an eighty acre cornfield abounding in ground squirrels. Not a tree nor a bush intervenes between this tree and the nearest farm yard a half mile away. Sitting on her lofty perch the female often spied her mate while he was still afar off, and with much screaming flew to meet him, and secure the prey he bore in his talons. Sometimes the meeting was no more than two or three hundred feet from the tree, but it was impossible to see her manner of seizing the quarry. Sometimes the male, still holding the prey, dashed by her to the tree, where still screaming she secured it. Once a ground squirrel retaining its head was brought in, all others were beheaded ones. The birds, headless, tailless, and wingless, were well plucked, yet the mother bird appeared to find some work to do on them before she delivered them

to the nest with scarcely the smallest feather remaining on them. Sometimes she skinned the ground squirrels, the nestlings ate the skins when she omitted the operation. The meadow mice were not skinned, but she always spent several minutes plucking out the hair, nevertheless much remained when taken to the nest. After she had snatched the prey from her mate, she usually uttered whine-like screams for two or three minutes before beginning her work on it. Crotches or peeling bark on the tree afforded her three or four places suitable for her flaying. In moving from place to place she sometimes carried the prey in her talons, but generally in her beak, and always thus when she flew from tree to nest. This flight she never made directly from her skinning places, but always descended to the lower branches of the willow by a series of short flights before starting for the nest; this she never did so long as she saw herself watched.

More vociferous screams than usual greeted my first appearance on the morning of June 28, awakening suspicions which were confirmed by a visit to the nest, and finding there that Moses had his head out of the entrance hole. After that hour one fledgling or another sat in the hole most of the time, shutting out the light and the fresh air. The weather was very hot, and the nest exceedingly filthy, yet that it was still "home, sweet home," to the hawklets was attested by the alacrity with which they hopped into it when held before the door. Jeremiah, the first born, marked by a red string on his foot, left the nest in the forenoon of June 30, some time between a quarter past eight o'clock and noon; and Ruth followed early the next morning. Frantic screams of the mother attended my search for Ruth. Very unlike the crouching, bustling, menacing creature of the previous evening was the very erect and slim little bird found perching in a willow sapling about fifty feet from the nest; and it was a gentle, farewell nibble that she gave the extended finger. Moses left the nest early in the morning of July 2, and Jezebel between five o'clock and half past that hour of the succeeding morning.

For a week the Hawks, old and young, staid about their tree. On the morning of July 11, the other birds sang a halleluiah chorus in the dead willow, that had been held by the Hawks for ninety-nine days; and no one could help wishing that the last had been

## WEIGHT OF SPARROW HAWKS IN GRAINS.

Egg.	No. 2.	No. 4.	No. 5.	No. 6.	
Weight. When fresh. On June 4.	227 —	225 186	228 192	204 174	Daily average weight.
	Jeremiah.	Ruth.	Jezebel	Moses	
1 <sup>1</sup>	154	157			
2	189	168	166		
3	253	229	191	139	203
4	363	325	248	180	279
5	465	421	365	233	371
6	632	559	520	330	510
7	786	695	621	424	631
8	898	804	755	559	754
9	1073	1002	918	711	926
10	1217	1150	1093	840	1075
11	1276	1230	1169	942	1154
12	1471	1339	1310	1076	1299
13	1586	1517	1391	1205	1424
14	1686	1641	1627	1307	1565
15	1720	1709	1704	1438	1642
16	1735	1770	1757	1495	1671
17	1757	1808	1795	1616	1744
18	1804	1856	1938	1512	1777
19	1771	1898	1818	1600	1771
20	1831	2000	2038	1811	1920
21	1848	1940	2006	1598	1848
22	1815	2050	2056	1740	1915
23	1809	1992	1988	1685	1868
24	1800	2040	2072	1761	1918
25	1749	2073	2090	1736	1912
26	1784	2036	2055	1680	1888
27	Left nest	2060	2062	1684	
28		Left nest	2069	1678	
29			2176	Left nest	
30			Left nest		

<sup>1</sup> Days in the lives of the Sparrow Hawks.

seen of the Sparrow Hawks, but they were not so obliging. During the next two weeks occasionally one or two of them came to the old tree. Not infrequently until the last of September three of them together were seen elsewhere. In the case of some other species it has been noted that sometimes the brood was divided, the father bird taking part of them some distance from the place in which the mother cared for the others. It remains for future investigations to decide whether the father Sparrow Hawks takes the males under his guidance, and the mother Hawk the females; whether the advocates of the system of segregation of sexes in education can claim a praise-worthy precedent in the practices of the Sparrow Hawks.

In the two months they remained in the neighborhood after leaving our place the Hawks were seen most frequently about the nearest farm yard to the northwest, about the county fair grounds, and on the public school grounds. At the last named place on several occasions they were seen to perch on the brackets of the cornice of the schoolhouse. Twice the days were rainy, and the birds may have returned for shelter to their accustomed roosting places.

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## ADDITIONAL NOTES FROM THE MOUNTAINS OF WESTERN NORTH CAROLINA.

BY FRANCIS M. WESTON, JR.

DURING the first three weeks of September, 1912, while staying in the mountains of Transylvania County, N. C., I was able to devote some of my time to the study of the bird life of the section. The results of this study may be of interest when taken in connection with the excellent paper published by Messrs. S. C. Bruner and A. L. Feild (*Auk*, XXIX July, 1912, pp. 368-377).

The greater part of my field work was done in a restricted locality